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~~Description~~

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~~Node supporting links having the ability to transfer longer messages than according to current MTP level 2~~

~~Background~~

Figure 1 shows the various protocol stacks for SS7 (Signalling system ~~nr.~~ no. 7) up to the MTP (message transfer part) level. Five stacks are currently defined. The first ~~one~~ stack is the well known stack for operation on 56/64kbit/s links.

Due to an increased bandwidth delay product, the MTP ~~(message transfer part)~~ level 2 (Q.703) is not ideally suited for speeds significantly above 64kbit/s. The elements which are problematic are window size, retransmission strategy, and the error rate monitor.

Three different protocol stacks which have been defined for use on T1/E1 links (1.5/2 MBit/s) address~~ing~~ some or all ~~three~~ of these problematic elements ~~aspects~~.

The latest edition of Q.703 contains, as a national option, a modification to the level 2 protocol which introduces 12 bit sequence numbers and a different error rate monitor (second column). Otherwise, the procedures are not changed.

Recommendation Q.2119 defines frame-relay framing for SSCOP (Service specific connection oriented protocol, Q.2110) to be used on a raw E1/T1 link (third stack). Thus, starting ~~Starting~~ at SSCOP, the complete broadband protocol stack can ~~thus~~ be used on high speed signalling links.

In addition, ~~Finally~~ Bellcore defines the complete ATM signalling protocol stack starting at the ATM layer for use on T1 signalling links with certain restrictions in the ATM layer, like not allowing multiple VCs (virtual channels) on a T1 link (column 4).

Lastly, the full ATM signalling protocol stack (column 5) ~~could~~ also could be used in narrowband networks.

Besides the potentially vastly different link speeds (which, however, pose no new interworking problems), the main difference between MTP level 2 based and SSCOP based signalling lies in the different maximum MSU length supported.

Of course, there is no need to actually make use of the longer MSU length supported by the ATM links in an enhanced narrowband signalling network. Indeed, the existing narrowband SS7 user parts would not even make use of the longer MSU length. We note, however, that the users of the SCCP can ~~indeed~~ generate messages in excess of 255 octets (the maximum data size supportable in single messages of the pre-96/97 SCCP). Such messages will be segmented before being delivered to the MTP. If such traffic would go via ATM links, avoiding the segmentation would benefit performance significantly.

new paragraph

Therefore, ~~we have~~ the situation exists that use of the larger MSU sizes - where needed and when possible - would be an additional welcome benefit of using the enhanced linksets.

~~SS7 Routing~~

Each node in an MTP network is identified by one signalling point code.

An MTP network is identified by the so-called *network indicator* in an MTP message.

Routing in the MTP is based on the so-called *destination (signalling) point code* (DPC) which identifies the destination of a *message signalling unit* (MSU) in an MTP network. In addition, the *signalling link selection field* (SLS) can be used do select between available routes of equal

priority (*combined linksets)* and to select a specific link within a linkset (a collection of links directly connecting two signalling points). No other information (like origination, MTP user, or MSU length) is generally evaluated for routing in the MTP.

The SCCP augments the MTP routing by providing additional functions to route on a so-called *global title* (GT), which can e.g. be a subscriber number of an 800-number. An SCCP routing on GT performs a process called *global title translation* (GTT) which derives the DPC of the final destination or the DPC of the next node (intermediate translator node) where the GT is further analyzed, eventually leading to the DPC of the final destination.

In addition to the GT the SCCP uses a so-called *subsystem number* (SSN) to identify the addressed SCCP user in the final destination.

This process also allows an SCCP message to cross MTP network boundaries.

In addition, the outcome of a GTT can depend on the availability status of the (next) destination. If the so-called *primary* destination, which would normally be the result of a GTT, or the addressed SSN is not available or reachable, an alternative destination can be the result of the GTT. This allows the SCCP to route messages to *backup* destinations (or backup intermediate translator nodes). Loadsharing between destinations is, in principle, also a possibility. Between two SCCP nodes the messages are routed by the MTP using the DPC provided by the SCCP.

State of the art

The interworking problem arising if use of longer messages in networks containing also linksets supporting only short messages is to be made has not been addressed in any detail.

Bellcore simply specifies that long messages destined for an MTP level 2 based link are to be discarded and that other~~wise~~ routing should be administrated accordingly.

A similar solution is proposed for the MTP based narrowband-broadband interworking in Q.2210.

For the SCCP, the possibility is defined to convert long LUDT(S) messages into segmented short XUDT(S) messages.

All these solutions, however, require appropriate planning of the routes supporting the longer messages and/or will not make optimal use of the capabilities available.

An MTP level 3 protocol based approach to solve such problem is described in Q.701. This solution, however, is incomplete.

~~Addressing based solution~~

This invention proposes to use the addressing mechanisms provided in MTP and SCCP to solve, or rather prevent, the above-described interworking problem. ~~This works as follows:~~

~~Each~~ node, which supports linksets having the ability to transfer longer messages than according to Q.703 (for example SSCOP-linksets), is assigned a second point code (in addition to its *narrowband* point code), which will be called *broadband* pointcode, identifying its enhanced functions; i.e., those which can generate long messages. An example of such a network is given in Figure ~~figure~~ 2. Routing tables in the MTP are engineered so that these *broadband* signalling points are only connected via linksets supporting the longer message length (see Tables ~~tables~~ 1 through ~~to~~ 3, for ~~an~~ example). Non-enhanced nodes would have no knowledge about the broadband point codes in the MTP network (see Tables ~~table~~ 5, for ~~an~~ example). For the interconnection of the narrowband point codes and the non-enhanced nodes (i.e., the nodes having only *narrowband* point codes) all linksets, however, would be available.

Thus the nodes supporting the enhanced links (nodes identified also by the broadband signalling point codes) together with the enhanced linksets would form an overlay network which can transport longer messages (see ~~figure~~ Figure 3). Even nodes having only the enhanced linksets would be identified by a narrowband and a broadband point code.

It is, however, still possible for the SCCP to reach a node (having a narrowband and a broadband point code) to which no enhanced route is currently available by appropriately engineering the SCCP GT translation data if this should be desired by the operator of the network. GT translation in the SCCP of a node having a narrowband and a broadband point code is engineered so that physical destinations (intermediate translators or final destinations) having a narrowband and a broadband point code have the broadband point code as the primary translation result and the narrowband point code as the backup translation result (see ~~table~~ Table 4).

As long as two signalling points are connected, an enhanced route will be used. If all enhanced routes between two nodes having a narrowband and a broadband point code fail, communication between the nodes will be via the linksets supporting only short messages, using the narrowband point codes as addresses.

In addition, this solution ~~can~~ also can be used for any new MTP users or appropriately modified existing MTP users like ISUP. Similarly, this solution ~~is~~ also is suitable for interworking between narrowband and broadband signalling networks.

Note that an alternative solution would be to use a different network indicator for the enhanced part of the signalling network which would have the advantage that there would be no restrictions in the available address space for point codes.

Table 1: **MTP routing table in node a/A without link failure**

destination	next node	
b	b	c
B	B	
c	c	b
d	b	c
D	B	

Table 2: **MTP routing table in node a/A with link A to B failed short messages can still reach all nodes via c**

destination	next node	
b		c
B		
c	c	
d		c
D		

Table 3: **MTP routing table in node a/A with link C-D failed long messages to D not possible anymore**

destination	next node	
b	b	c
B	B	
c	c	b
d	b	c
D		

Table 4: SCCP global tile translation in node a/A for GT resulting in addressing the SCCP (or one of its users) in node d/D

primary result (MTP address)	backup result (MTP address)
D (long message allowed)	d (segmentation required)

Table 5: MTP routing table in node c without link failure

destination	next node	
a	a	b
b	b	
d	d	b